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EDITORIAL COMMENT

Aortic and coronary atherosclerosis: a natural association?

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Several studies have demonstrated an association between coronary and aortic atherosclerosis [1–7]. For instance, risk factors are similar for the development of both thoracic aortic aneurysms and other cardiovascular diseases. Coronary artery disease (CAD) is highly prevalent in patients with thoracic aortic aneurysms, with a reported prevalence of 30–70%. Knowledge of the underlying cardiac pathology can minimize perioperative risk and improve patient selection. This may allow for the optimal screening, diagnosis and management of patients with this common and potentially lethal disorder. Cardiovascular imaging may play a crucial role in the early detection of the total atherosclerotic burden. The atherosclerotic burden can be used as an indicator of the extent of the atherosclerotic process in the aorta through the use of both metabolic and morphologic data. Imaging of the aorta and the aortic wall can been performed by various imaging modalities such as transesophageal echocardiography (TEE) [1, 4], radionuclide imaging [8–13], cardiovascular magnetic resonance (CMR) [14–20], and computed tomography (CT), whereby CMR and CT also allow visualization of the coronary arteries [21–36]. Latest publications using TEE have reported a significant correlation between wall changes in the thoracic aorta and angiographic extent of coronary artery stenosis in patients with severe CAD [1, 2, 4]. Tatsumi et al. [37] showed that the combination of FDG-PET/CT depicted FDG uptake commonly in the affected thoracic aortic wall. The FDG uptake site was mostly distinct from the calcification site and may possibly be located in areas of metabolic activity of atherosclerotic changes i.e. macrophages. Adame et al. [38] developed an automated technique to trace the contours of the lumen and outer boundary of the aortic wall using CMR, allowing the measurement of aortic wall thickness in axial CMR images. The used algorithm proved to be a powerful tool to automatically draw the boundaries of the aortic wall and measure aortic wall thickness in aortic wall devoid of major lesions. Maroules et al. [39] showed that black-blood CMR of aortic atherosclerosis was very reproducible. Parallel imaging at 3-Tesla permitted shorter scan time compared with conventional 1.5-Tesla imaging with comparable measures of atherosclerosis extent. Malayeri et al. [40] determined the relation between aortic wall thickness and aortic distensibility with traditional cardiovascular risk factors in the multi-ethnic study of atherosclerosis (MESA) cohort. In total, 1,053 participants in MESA underwent CMR for the measurement of aortic wall thickness and aortic distensibility. The authors showed that older age and higher blood pressure

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were associated with higher aortic wall thickness and lower aortic distensibility. Decreased aortic distensibility was further associated with current smoking, African American ethnicity, and higher high-density lipoprotein cholesterol level.

Sakuta et al. [41] evaluated delayed enhancement on CT of the aortic wall of atherosclerotic aneurysms and showed delayed enhancement in 66 of 110 patients (60%) with atherosclerotic abdominal aortic aneurysms which may therefore be associated with chronic inflammation by atherosclerosis. Mao et al. [42] showed with multidetector computed tomography (MDCT) that the ascending aortic diameter increased with age and male gender. Gender-specific and age-adjusted normal values for aortic diameters are necessary to differentiate pathologic atherosclerotic changes in the ascending aorta. Takasu et al. [5] assessed aortic atherosclerosis with electron-beam CT as an independent predictor of obstructive CAD in 76 patients. It was demonstrated that aortic plaque detected with contrast-enhanced electron-beam CT was a more consistent predictor of obstructive CAD than other independent aortic variables.

In the current issue of the International Journal of Cardiovascular Imaging, Jeltsch et al. [43] assessed aortic wall thickness using MDCT as a predictor of coronary atherosclerosis. Purpose of the study was the evaluation of the thoracic aortic wall thickness in 160 patients as a potential identifier of patients at increased risk for future cardiac events. Relationships between aortic wall thickness, sex, age, major risk factors and atherosclerotic plaque burden of the coronary arteries were studied. Higher values of maximum aortic wall thickness of the descending aorta were found in patients with coronary atherosclerosis compared to patients with same gender but excluded atherosclerosis. Aortic wall thickness of the mid-portion of the descending aorta of 3.0 mm or greater was associated with CAD with a specificity of 96.6% (sensitivity 27.5%) and a positive predictive value of 93.3%. For patients with two or more major risk factors and a maximum wall thickness of equal or more than 2.6 mm a positive predictive value of 100% was found for the presence of coronary atherosclerosis. Interestingly, 91% of the patients presenting with calcifications of the thoracic aorta also showed calcified or non-calcified plaques of coronary vessels. However, aortic wall measurements were not suitable to discriminate patients with obstructive from non-obstructive CAD.

In conclusion, the study of Jeltsch et al. [43] shows that measurement of maximum wall thickness of the descending aorta utilizing MDCT is a potential tool for detecting patients with subclinical coronary atherosclerosis. In addition, this study shows together with most of the above-mentioned CT studies—the potential of dynamic imaging of the thoracic aorta and cardiac structures and function, including the coronary arteries, with just a single MDCT scan. The images can be successfully assessed for thoracic aorta pathology, cardiac disease, coronary atherosclerosis and extracardiac pathology. The potential effect of combining measurements of aortic wall thickness at routine chest CT studies with a possible cardiovascular screening is substantial. This is in line with the so-called triple rule-out protocol allowing the simultaneous evaluation of aortic pathology, coronary atherosclerosis and pulmonary embolism [44]. With further developments of CT scanners-and more detailed insight in the prognosis of patients based on ECG-gated CT angiography findings-the MDCT technique may become the initial imaging modality for preoperative cardiac risk stratification in patients with severe aortic pathology such as thoracic aortic aneurysms, aortic dissections and advanced aortic atherosclerosis.

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